

Concrete Pavement Repair

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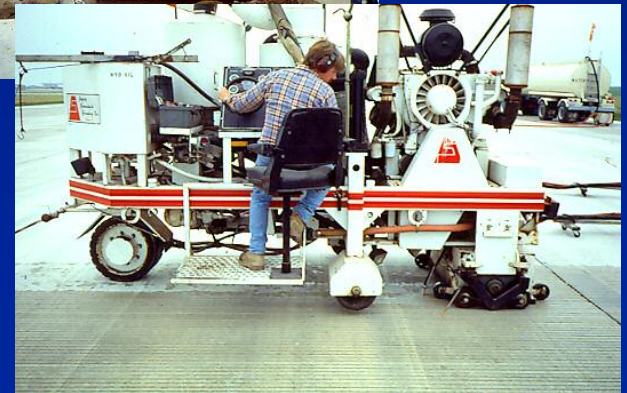
Basis of Information

- UFC 3-270-04
- ACPA JP002P



Topics Covered

- Distresses
- Repair/restoration
 - Partial-depth repair
 - Full-depth repair
- Surface issues
 - Diamond grinding / grooving



Distress Classification

Cracking

- Extends through the depth of a slab
- Caused by:
 - Poor Design - Long joint spacing
 - Poor Construction (Over Finished Surfaces)
 - Curling / warping (Stabilized bases)
 - Base / edge / dowel restraint
 - Load

Transverse Cracking



Longitudinal Cracking



Corner Breaks



Cracks and Causes

- Full Width of Panel (Slab)
 - Environmental Distress
 - Sealing (Routing) Most Effective
- Corner Cracks (Diagonal)
 - Load Distress
 - Full Depth Replacement Mandatory
- Shattered Slabs - More than Four Pieces
 - Full Depth Replacement Required

Rules for Concrete Cracks

- | | |
|-----------------------|----------------------|
| • to 1/4-inch | Leave alone |
| • 1/4 to 1/2-inch | Route and Seal |
| • 3/8 to 3/4-inch (S) | Partial Depth Repair |
| • 3/4 to 1-1/2 | Rout and Seal |
| • 3/4 to 1-1/2 (S) | Full Depth Patching |
| • More than 1-1/2 | Full Depth Patching |

Distress Classification

Spalling

- Breaking, cracking, or chipping at joints or cracks
 - Incompressible in Joint / Crack
 - Material Durability Problems
 - Poor Construction Techniques
- Full Depth Repair Required when unsound material deeper than $\frac{1}{3}$ thickness

Spalling



Distress Classification

Faulting

- Breaking, cracking, or chipping at joints or cracks
 - Incompressible in Joint / Crack
 - Material Durability Problems
 - Poor Construction Techniques
- Full Depth Repair Required when unsound material deeper than $\frac{1}{3}$ thickness

Faulting



Faulting



Why Repair?

- First level of response for deteriorating concrete pavements should always be repair
 - Least cost
 - Best return on investment
 - Least service disruption

Purpose of Repair Techniques

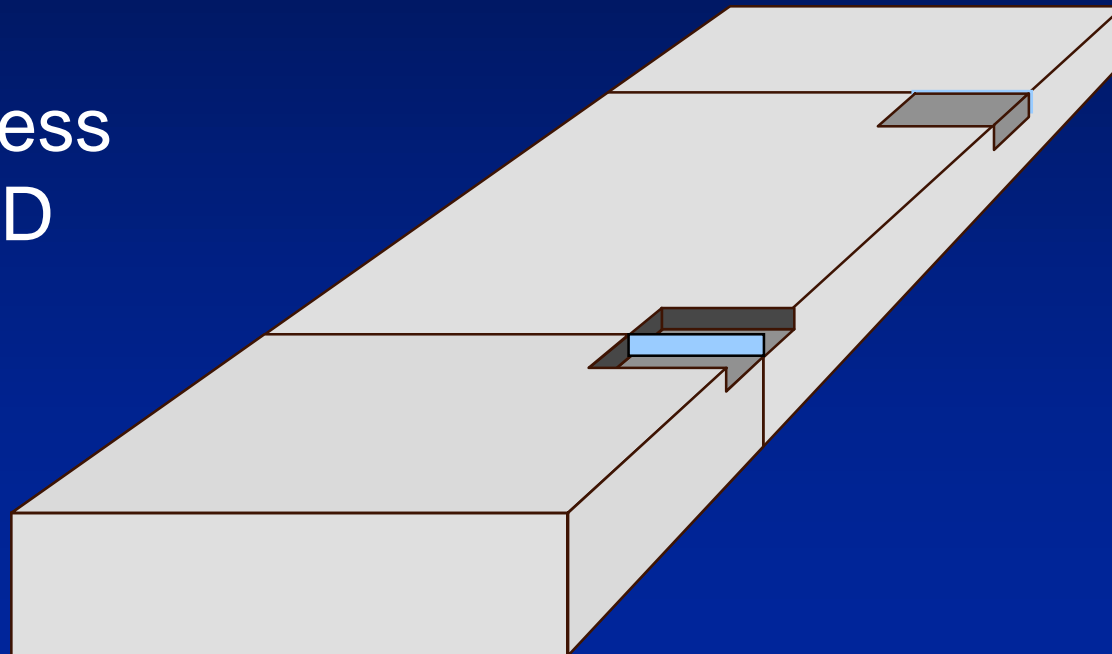
- Repair particular distress
- Prevent recurrence of distress
- Improve pavement capacity
 - Structure
 - Traffic
 - Ride

Repair Techniques

- Slab Stabilization
- **Partial-Depth Patching**
- **Full-Depth Patching**
- Dowel Bar Retrofit (Load Transfer Restoration)
- **Diamond Grinding**
- Resealing Joints & Cracks
- Cross-stitching long. cracks/joints

Partial Depth Repair

If distress less
than $\frac{1}{3} D$



Partial Depth Repair

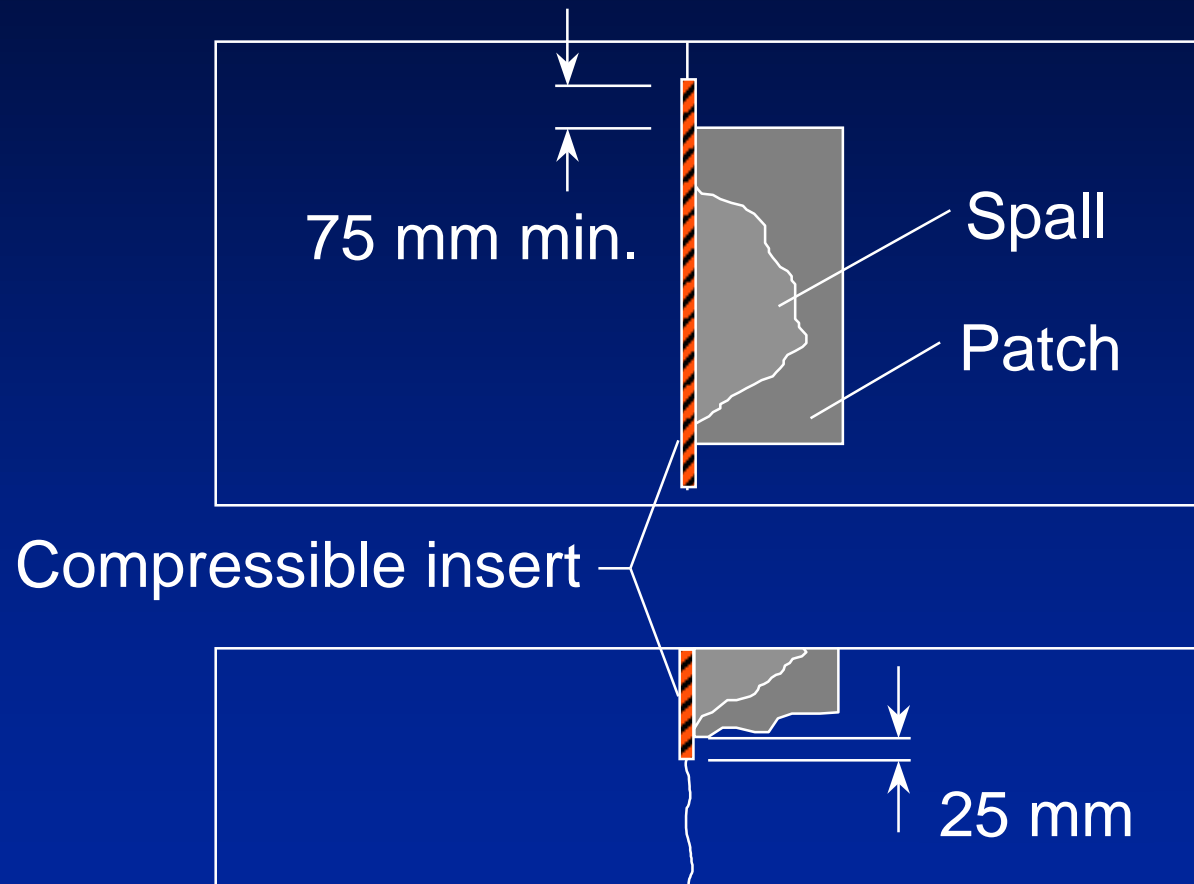








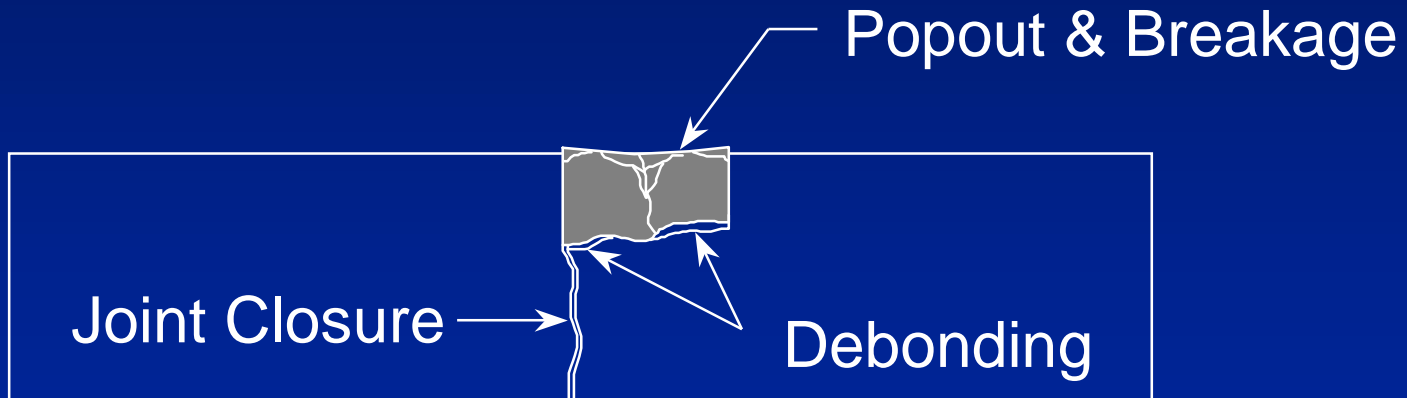
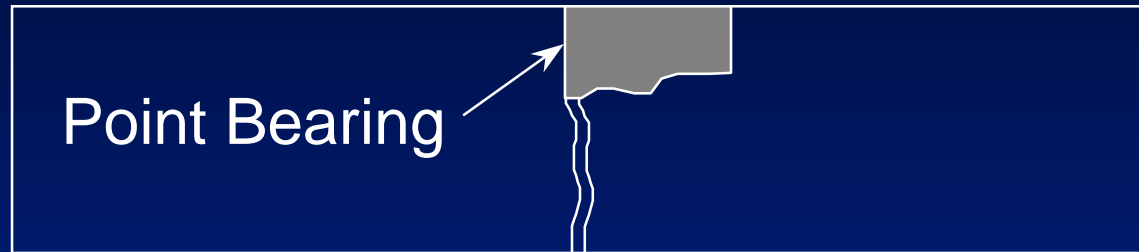
Compressible Insert



Joint Insert

- Separates patch from adjacent lane
- Reforms joint reservoir
- Provides uniform sealing reservoir
- Acceptable materials:
 - Styrofoam
 - Asphalt-impregnated fiberboard
 - Fiberboard

If Insert Not Used...



Expansion ➡ ➡ Expansion

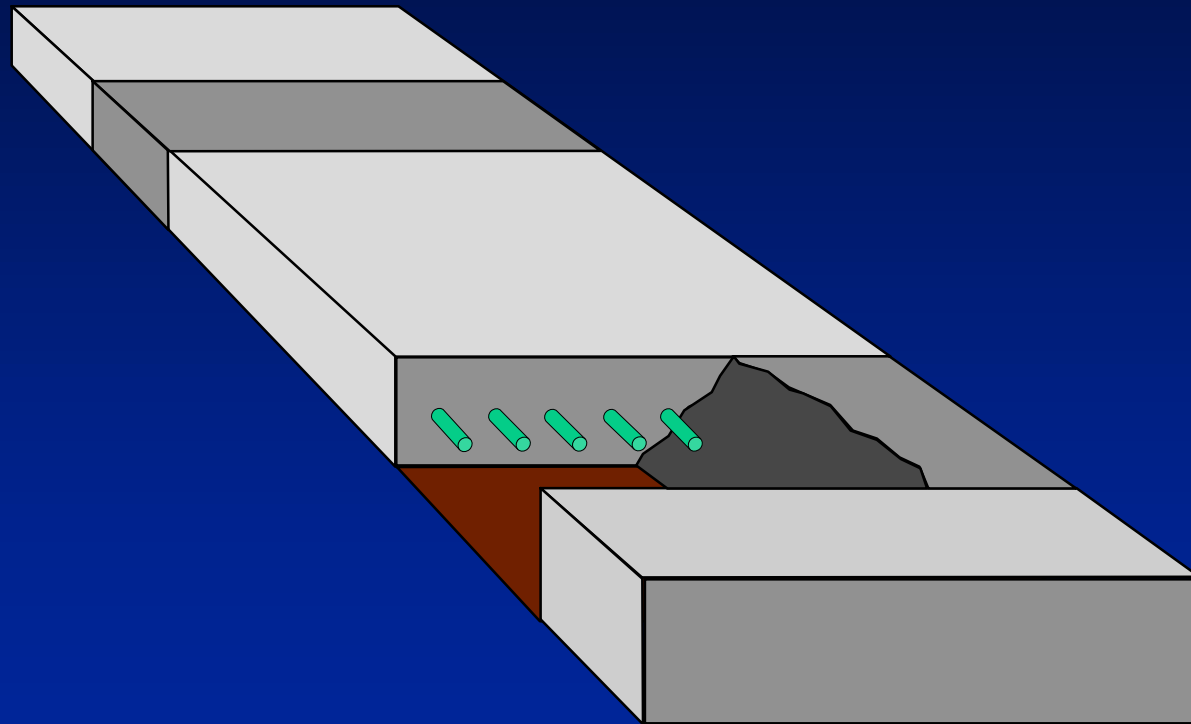




Keys to Partial Depth Repair

- Patch material is durable
 - freeze-thaw
- Patch area is clean
 - sandblast + air blast
- Backfill mixed in small quantities
 - follow manufacturer's instructions
- Re-form joint across slot
 - prevent point bearing

Full Depth Repair

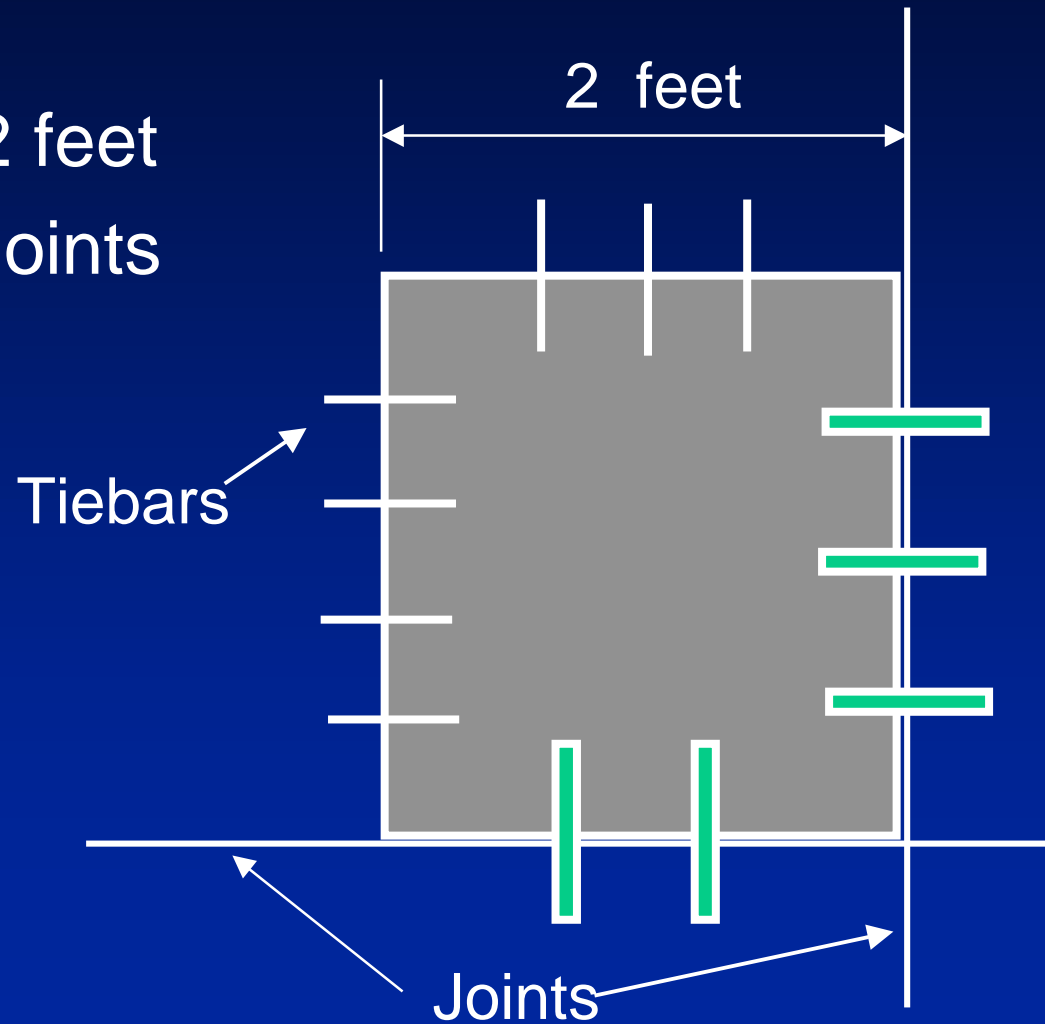


Full Depth Repair



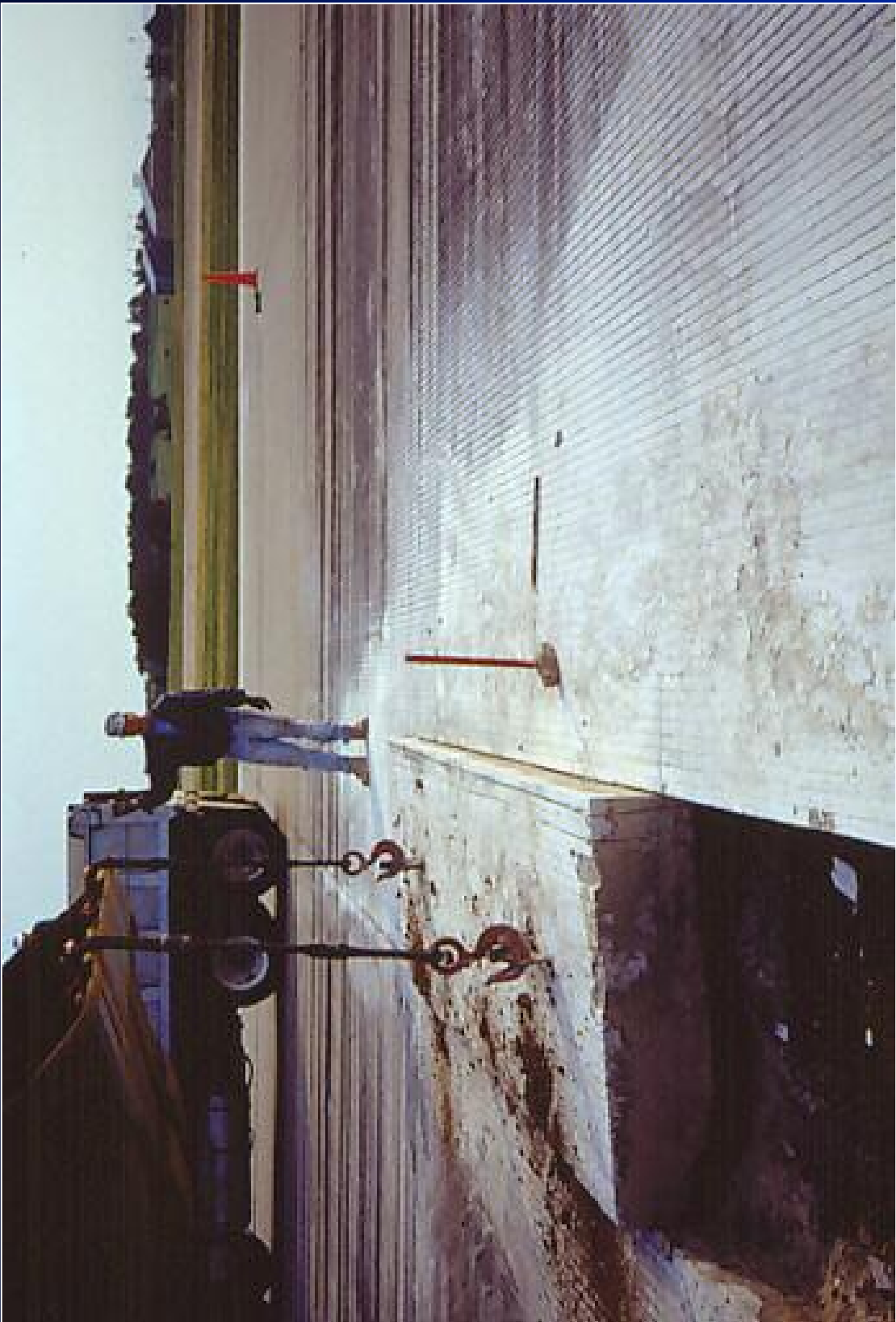
Full Depth Repairs

- Minimum repair 2 feet
- Full depth cut at joints
- Diamond blades
- Tie to existing













Gang Drill Dowel Holes (slab surface reference)



Gang Drill (base reference)



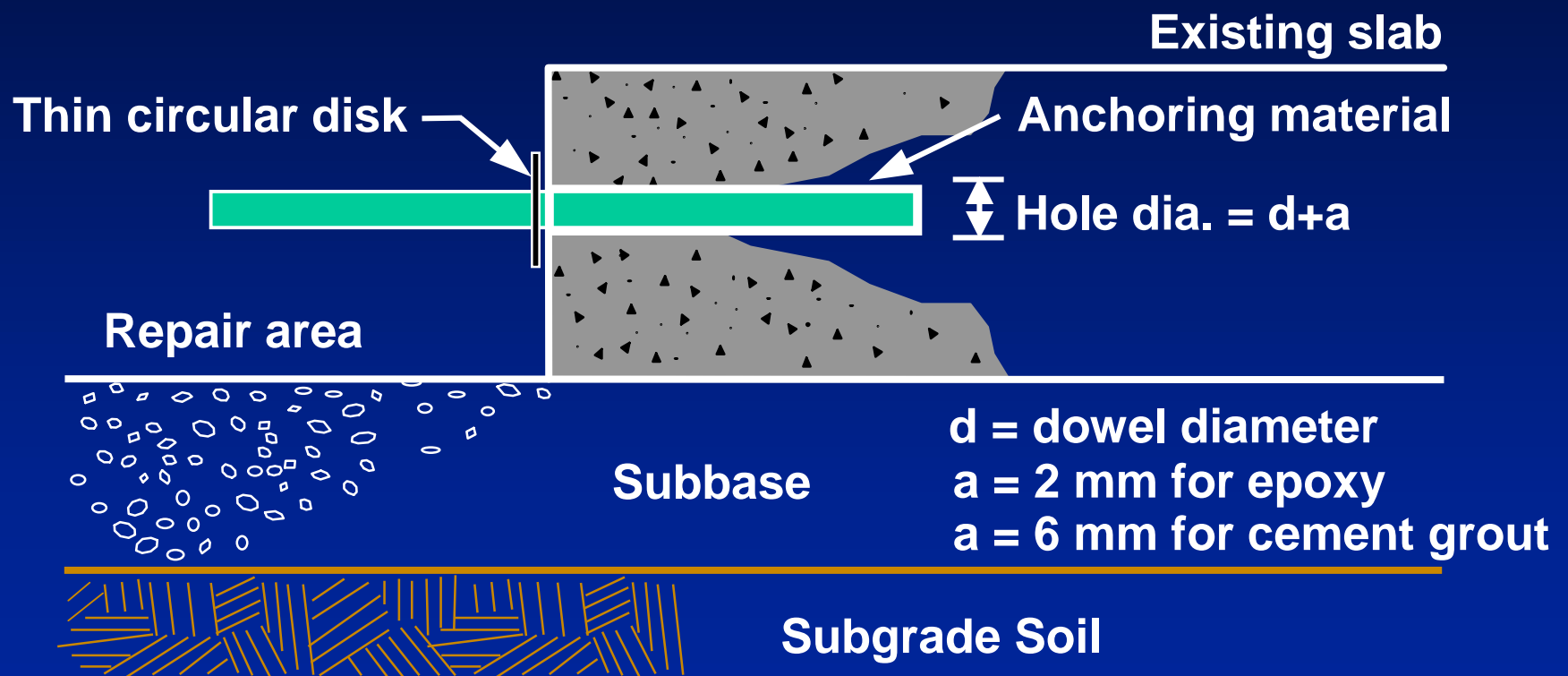
Gang Drill (boom reference)



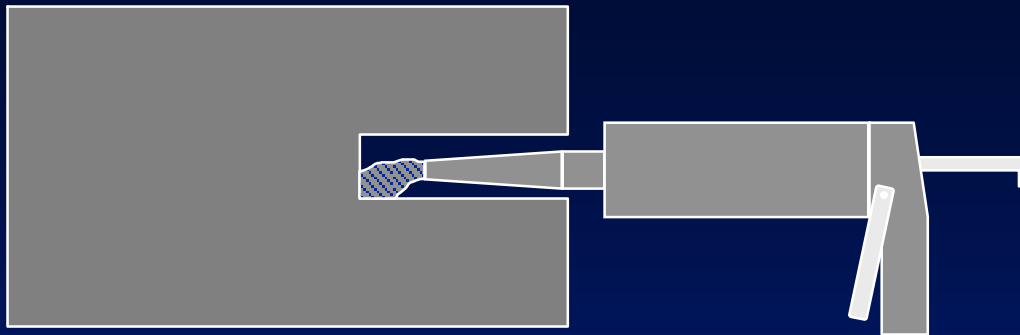
Cleaning Holes (Air Blast)



Dowel Bar Placement for Full Depth Repairs

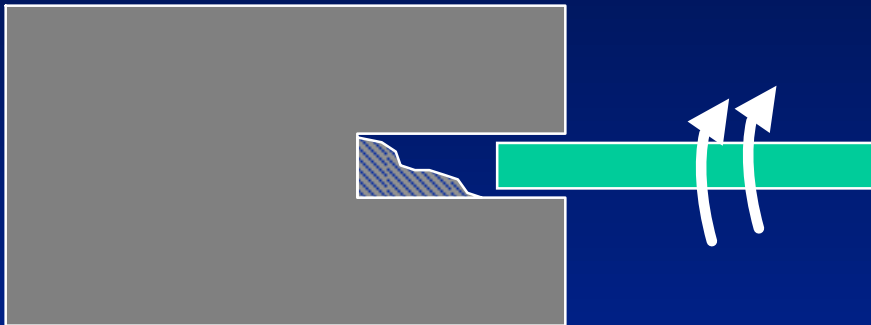


1



Inject Grout
to Back of Hole

2



Twist one turn
while pushing
in dowel

3



Place grout
retention disk to
hold in grout







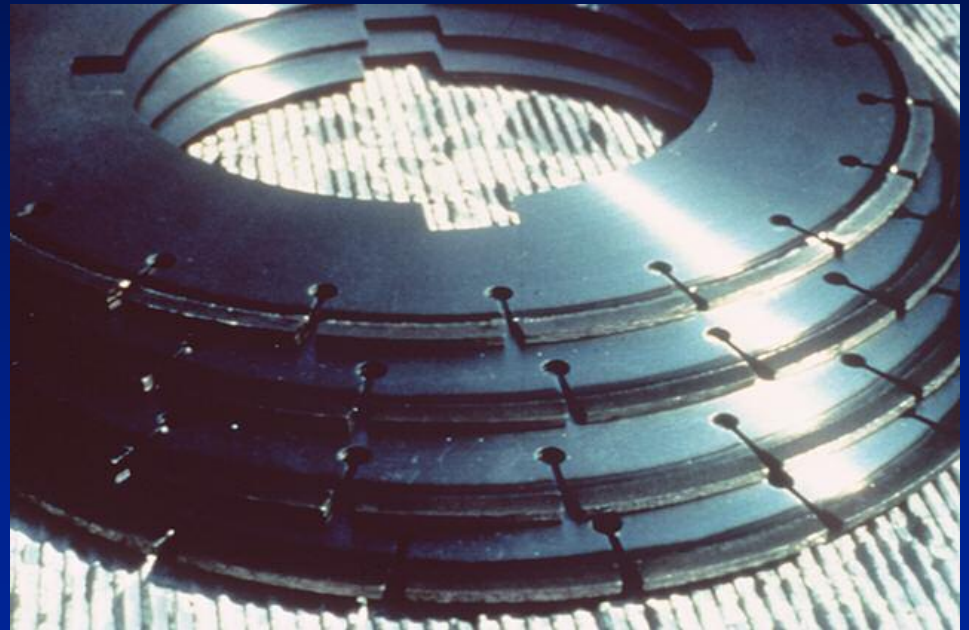


Keys to Full Depth Repair

- Accurate layout / estimate of quantities
- Re-establish load transfer
 - drill & grout dowels on both sides
- Strike-off level with surrounding pavement
- Good mix design & curing regimen

Diamond Grinding

- Removes roughness
- Removes polished concrete surface
- Removes rubber build-up



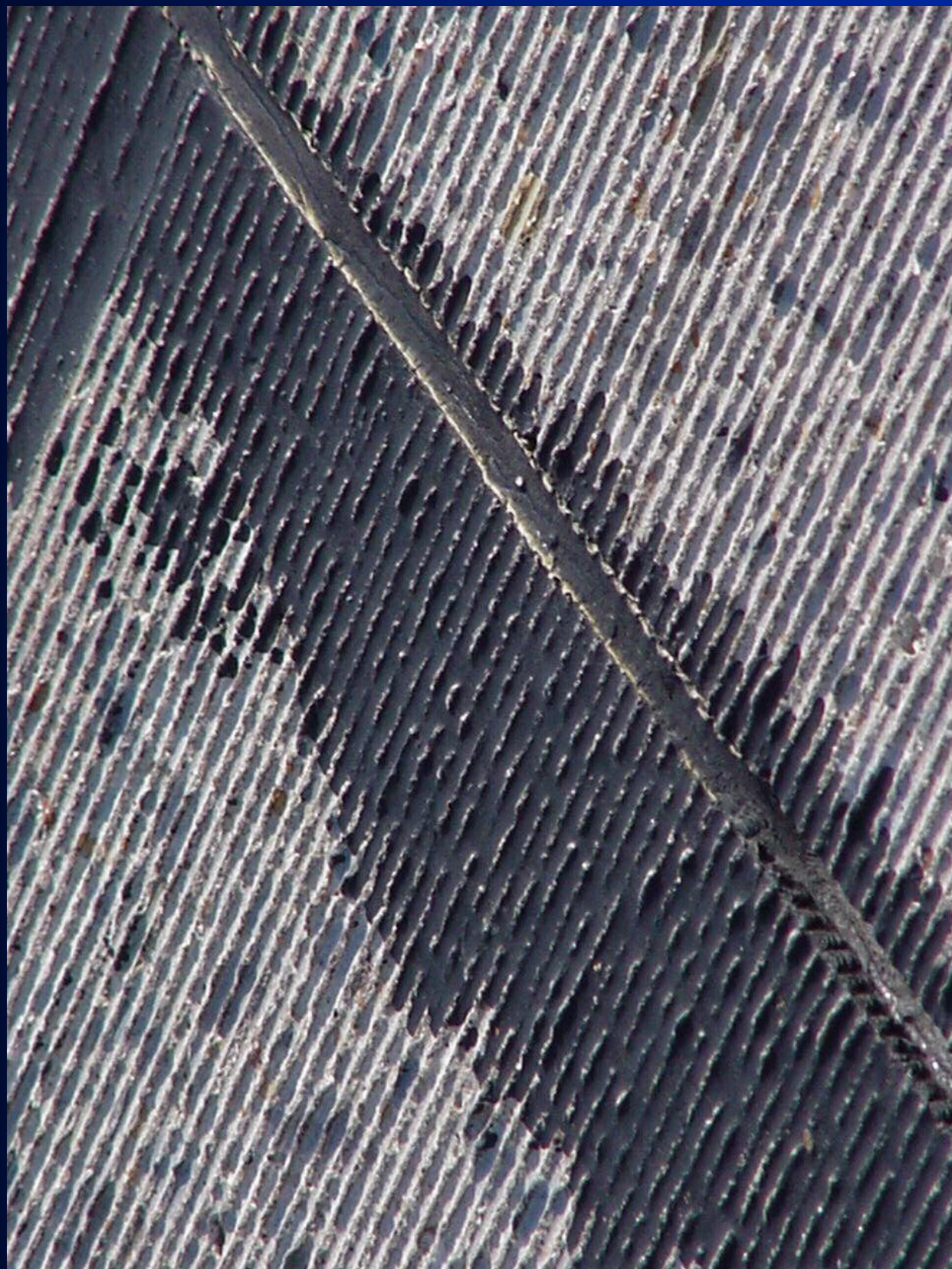
Diamond Grinding

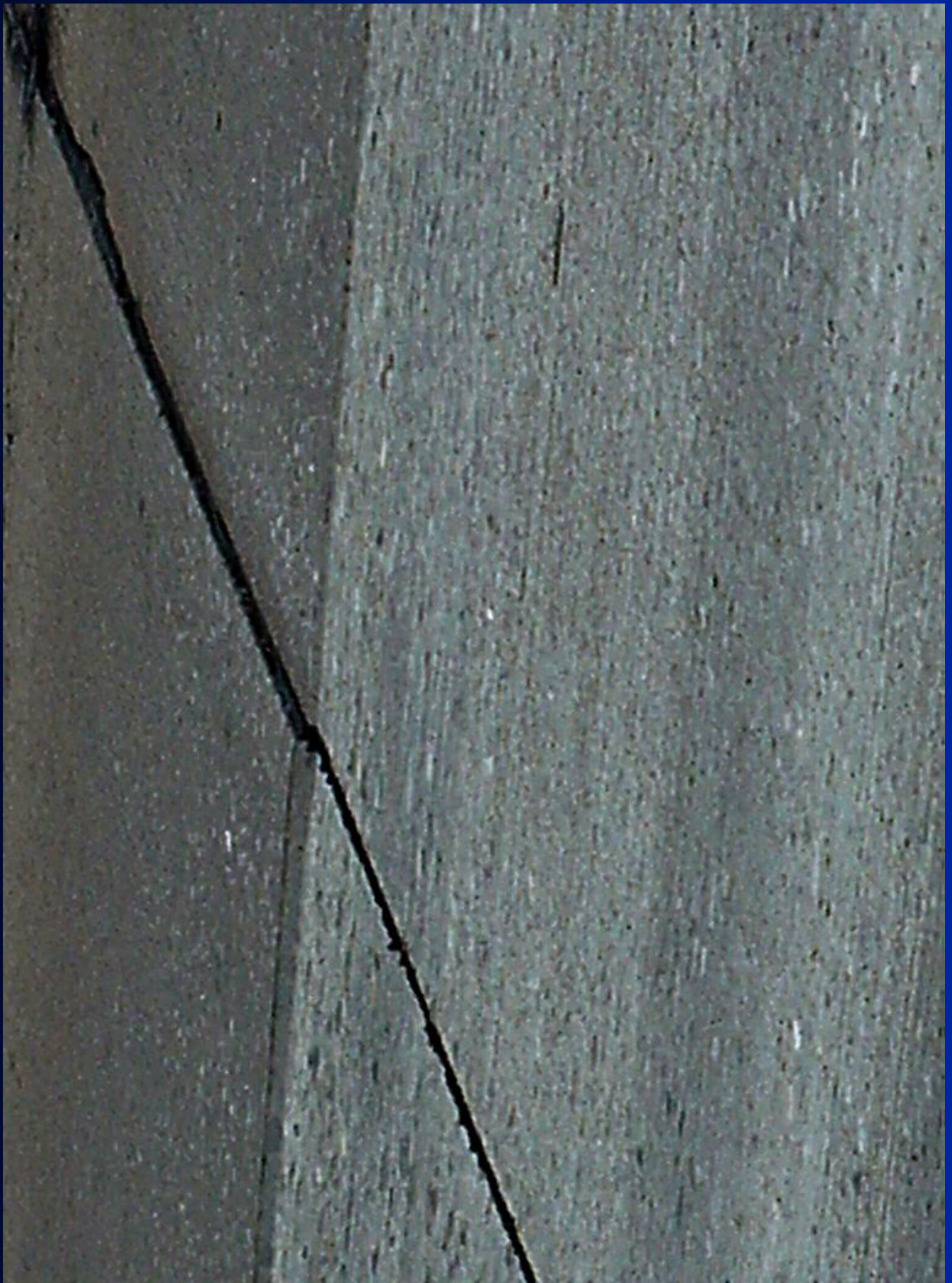












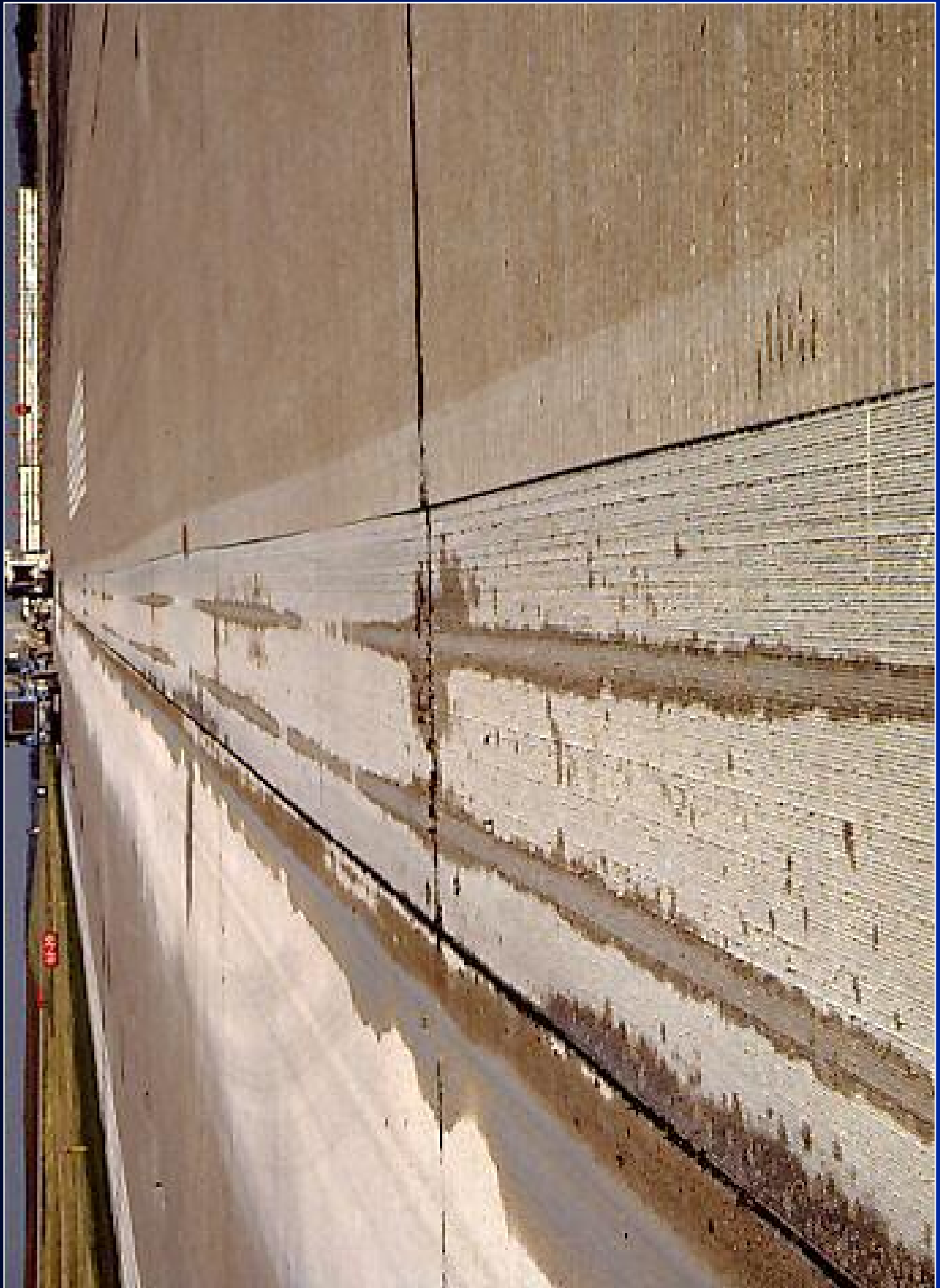














Bump Removal



Night Grinding Restoration Work



Safety Grooving for Runways

- First used by British in 1956 to improve friction characteristics of wet runways
- NASA begins runway grooving research in 1962
- Adopted as a standard technique used to improve runway characteristics in 1967

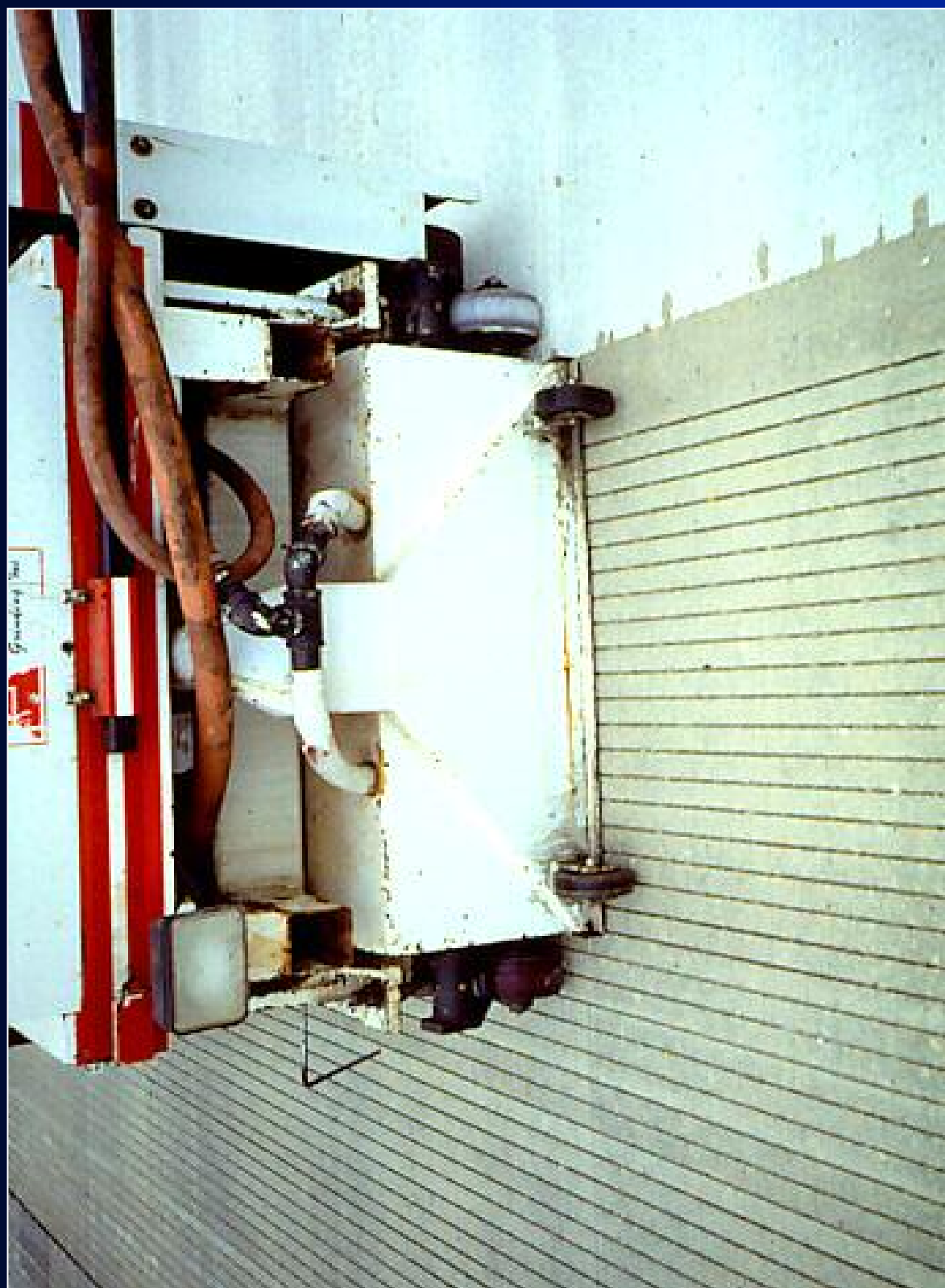
Safety Grooving for Runways

- First commercial use at Washington National Airport in 1967 – transverse grooves sawed into bituminous surface, .625" X .625" X 1"
- First commercial use on a PCC runway at Kansas City International Airport in 1968, .25" X .25" X 1.25"

Safety Grooving for Runways

- Standardized by FAA in 1978 via Advisory Circular
- Grooves sawed transverse to runway
- .25" X .25" X 1.5"
- AKA Deep Groove Concept
- Most major airports in the US contain at least one grooved runway

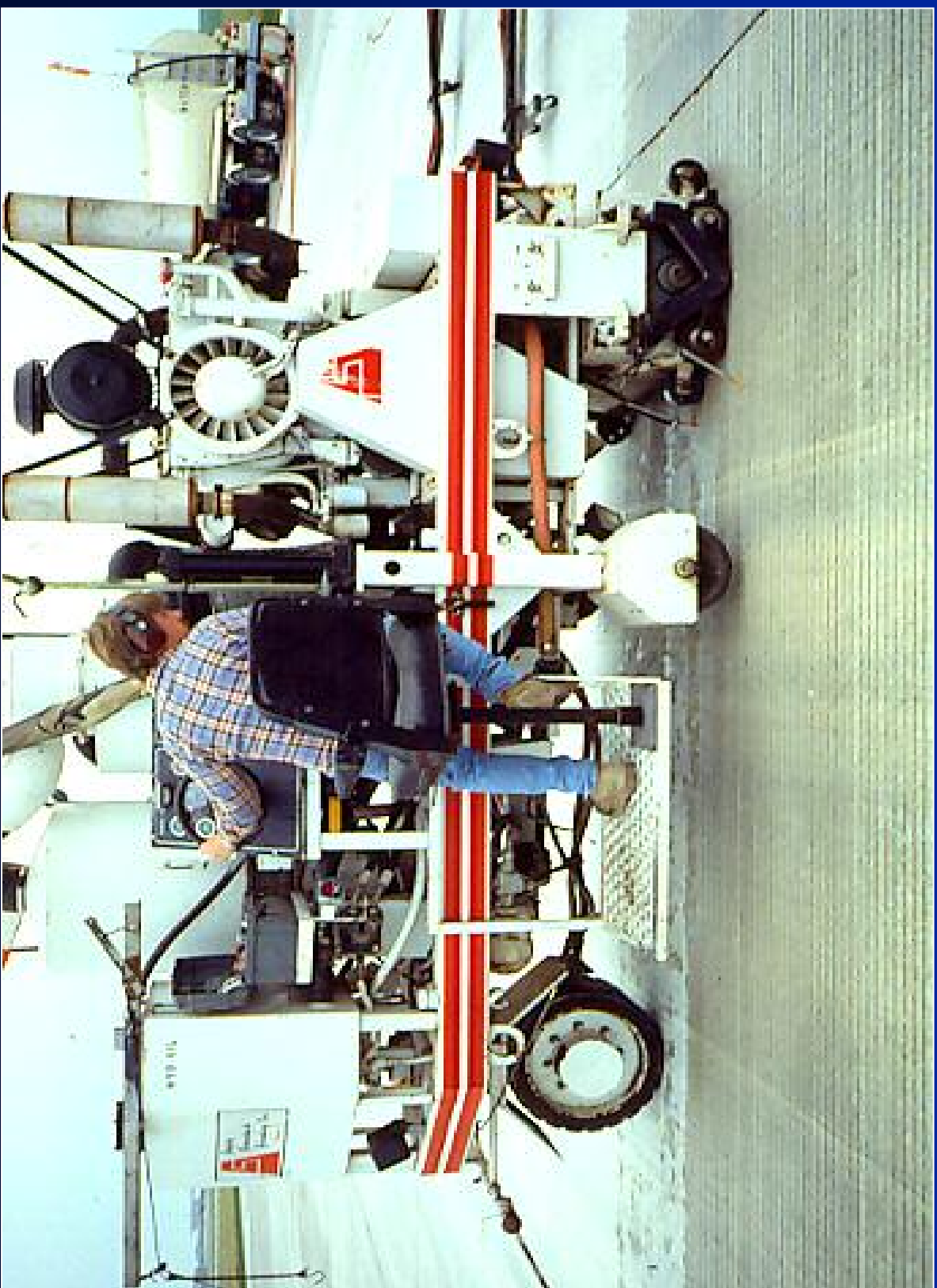






Re-Grooving Pavement Surfaces

- New grooves must match depth, width and spacing of original grooves
- A skilled operator and properly set equipment are essential for accurate groove tie-in
- Re-grooving takes more time and patience than virgin grooving









Keys to Diamond Grinding

- Understand pavement conditions
 - roughness, aggregate type, concrete strength
- Grinding head setup
 - blade type & spacing related to aggregate hardness, roughness, etc.
- Correct blade spacing improves:
 - reduction in hydroplaning
 - longevity of surface

Summary

- Proper techniques are available to repair & maintain pavements
- The techniques are used to *correct* pavement distresses and *prevent* their occurrence, not cover them up
- Concrete overlays can help solve problems with asphalt pavements and prevent the “mill & fill” scenario



Concrete Rehabilitation Procedures Serve Facilities for All Types of Traffic

For more information...

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ANY QUESTIONS?